EKSPLORASI BAKTERI UREOLITIK YANG MAMPU MEMPRESIPITASI KALSIT DARI KARST *GEOSITE* SILOKEK, SIJUNJUNG, SUMATERA BARAT

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ABSTRAK

Kawasan karst merupakan ekosistem unik yang memiliki kondisi lingkungan ekstrem, seperti kandungan nutrisi yang rendah, pH cenderung basa, dan kandungan mineral kalsium yang tinggi. Kondisi tersebut mendukung keberadaan bakteri ureolitik yang mampu menghasilkan enzim urease untuk menghidrolisis urea sehingga memicu presipitasi kalsium karbonat ($CaCO_3$) melalui mekanisme *Microbially Induced Calcium Carbonate Precipitation* (MICP). Penelitian bertujuan untuk memperoleh isolat bakteri ureolitik dari Karst *Geosite* Silokek, Sijunjung, Sumatera Barat, menguji kemampuannya dalam mempresipitasi kalsium karbonat, serta mengkarakterisasi isolat yang diperoleh. Pengambilan sampel menggunakan metode *purposive random sampling* pada karst. Isolasi bakteri dilakukan menggunakan metode pengenceran bertingkat, dilanjutkan dengan uji urease secara kualitatif, pengujian presipitasi kalsium karbonat secara kuantitatif, serta karakterisasi dilakukan berdasarkan pengamatan makroskopis, mikroskopis, pewarnaan Gram, dan uji biokimia. Hasil penelitian menunjukkan bahwa diperoleh sembilan isolat bakteri, dengan tujuh isolat menunjukkan aktivitas urease positif. Seluruh isolat ureolitik mampu mempresipitasi $CaCO_3$ dengan berat presipitat berkisar antara 0,15–0,53 g. Isolat DLK 1 yang berasal dari dinding bukit batu kapur menghasilkan presipitat tertinggi, yaitu 0,53 g, sedangkan isolat TKT 1 menghasilkan presipitat terendah, yaitu 0,15 g. Karakterisasi menunjukkan isolat memiliki variasi morfologi koloni, didominasi bentuk sel basil, terdiri atas bakteri Gram positif dan Gram negatif, seluruh isolat bersifat katalase positif, serta sebagian besar bersifat oksidase positif. Penelitian ini menunjukkan bahwa kawasan Karst Geosite Silokek merupakan sumber bakteri ureolitik yang berpotensi dimanfaatkan dalam aplikasi biomineralisasi, khususnya teknologi MICP untuk biosementasi dan perbaikan material berbasis kalsium karbonat.

Kata kunci: bakteri ureolitik, karst Geosite Silokek, MICP, presipitasi kalsium karbonat, urease.

ABSTRACT

Karst ecosystems are unique environments characterized by extreme conditions, including low nutrient availability, relatively alkaline pH, and high calcium mineral content. These conditions support the presence of ureolytic bacteria capable of producing the urease enzyme, which hydrolyzes urea and subsequently induces calcium carbonate ($CaCO_3$) precipitation through the Microbially Induced Calcium Carbonate Precipitation (MICP) mechanism. This study aimed to obtain ureolytic bacterial isolates from the Silokek Karst Geosite, Sijunjung, West Sumatra, evaluate their ability to precipitate calcium carbonate, and characterize the isolates obtained. Samples were collected using a purposive random sampling method from the karst area. Bacterial isolation was performed using the serial dilution method, followed by qualitative urease testing, quantitative calcium carbonate precipitation assays, and characterization based on macroscopic and microscopic observations, Gram staining, and biochemical tests. The results showed that nine bacterial isolates were obtained, of which seven exhibited positive urease activity. All ureolytic isolates were capable of precipitating $CaCO_3$, with precipitate weights ranging from 0.15 to 0.53 g. Isolate DLK 1, obtained from a limestone hill wall, produced the highest amount of precipitate at 0.53 g,whereas isolate TKT 1 produced the lowest amount at 0.15 g. Characterization revealed variations in colony morphology, with cells predominantly exhibiting a bacillary shape. The isolates consisted of both Gram-positive and Gram-negative bacteria. All isolates were catalase-positive, while most were oxidase-positive.These findings demonstrate that the Silokek Karst Geosite is a potential source of ureolytic bacteria that may be utilized in biomineralization applications, particularly MICP technology for biocementation and the repair of calcium carbonate-based materials.

Keywords: Ureolytic bacteria, Karst Geosite Silokek, Microbially Induced Calcium Carbonate Precipitation (MICP), calcium carbonate precipitation, urease.